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IPEA/ EP

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty.

For International Preliminary Examining Authority use only	
Identification of IPEA	Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION Applicant's or agent's file reference P2137PC00	
International application No. PCT/NO04/00174	International filing date (day/month/year) 11.06.2004 (Earliest) Priority date (day/month/year) 13.06.2003
Title of invention Method and device for combining images from at least two light projectors	
Box No. II APPLICANT(S)	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) CYVIZ AS Forus Atrium N-4313 Sandnes Norway	Telephone No.
	Facsimile No.
	Teleprinter No.
	Applicant's registration No. with the Office
State (that is, country) of nationality: NO	State (that is, country) of residence: NO
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) HARBOE, Øyvind Bruvikbakken 3 N-4017 Stavanger Norway	
State (that is, country) of nationality: NO	State (that is, country) of residence: NO
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) 	
State (that is, country) of nationality:	State (that is, country) of residence:
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.	

Sheet No. .2

International application No.
PCT/NO04/00174**Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**The following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: *(Family name followed by given name; for a legal entity, full official designation.
The address must include postal code and name of country.)*PROTECTOR INTELLECTUAL PROPERTY
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☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☐ the international application as originally filedthe description ☒ as originally filed☐ as amended under Article 34the claims ☐ as originally filed☐ as amended under Article 19 (together with any accompanying statement)☒ as amended under Article 34the drawings ☒ as originally filed☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ Where the IPEA wishes to start the international preliminary examination at the same time as the international search in accordance with Rule 69.1(b), the applicant requests the IPEA to postpone the start of the international preliminary examination until the expiration of the applicable time limit under Rule 69.1(d).4. ☐ The applicant expressly wishes the international preliminary examination to start earlier than at the expiration of the applicable time limit under Rule 54bis.1(a).

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

☒ which is the language in which the international application was filed.☐ which is the language of a translation furnished for the purposes of international search.☐ which is the language of publication of the international application.☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.**Box No. V ELECTION OF STATES**

The filing of this demand constitutes the election of all Contracting States which are designated and are bound by Chapter II of the PCT.

Sheet No. ...

International application No.

PCT/NO04/00174

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | | |
|--|---|-------|--------|
| 1. translation of international application | : | _____ | sheets |
| 2. amendments under Article 34 | : | 2 | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | _____ | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | _____ | sheets |
| 5. letter | : | 2 | sheets |
| 6. other (<i>specify</i>) | : | _____ | sheets |

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received not received

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<input type="checkbox"/>	<input type="checkbox"/>
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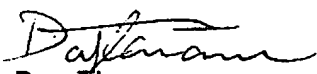
The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 5. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> original separate power of attorney | 6. <input type="checkbox"/> sequence listing in electronic form |
| 3. <input type="checkbox"/> original general power of attorney | 7. <input type="checkbox"/> tables in electronic form related to a sequence listing |
| 4. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 8. <input type="checkbox"/> other (<i>specify</i>): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

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Dag Thrane
Patent Attorney

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1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the time limit of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

6. ☐ The date of receipt of the demand is AFTER the expiration of the time limit under Rule 54bis.1(a) and item 7 or 8, below, does not apply.

7. ☐ The date of receipt of the demand is WITHIN the time limit under Rule 54bis.1(a) as extended by virtue of Rule 80.5.

8. ☐ Although the date of receipt of the demand is after the expiration of the time limit under Rule 54bis.1(a), the delay in arrival is EXCUSED pursuant to Rule 82.

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Demand received from IPEA on:

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BY MAIL AND FACSIMILE NO.: +31 70 340 3016

Oslo April 11, 2005

Your ref.: PCT/NO04/00174
Our ref.: P2137PC00

International PCT Application No. PCT/NO04/00174

It is not the goal of Cyviz' patent to achieve color or luminance uniformity across multiple projectors. In Cyviz' experience, in our experience this is not practical as it reduces the dynamic range of the projectors' output.

Modern projectors need to strike a compromise between bandwidth, refresh rates and dynamic output range. Usually the dynamic range is just above the minimum level required for artifacts not to be visible. E.g. what WO 02/19704 suggests would produce terrible banding effects and I seriously doubt that any commercial embodiments exist or would ever be made.

It is possible that these banding effects could be mitigated by some dithering pattern, but it has to be kept in mind that the projector could very well already be using dithering techniques to deal with refresh/bandwidth issues. The resulting interference from our experiments renders such implementations impractical.

Cyziv' approach to the color+luminosity uniformity problem, is to leave the pixels as much as possible unchanged to preserve dynamic range, instead relying on the eyes low sensitivity to low spatial frequency changes. The edge blending is used to reduce the sharp visible edge between the projectors, spreading out (but not compensating for) the difference in luminosity and color over a wider area.

WO 02/19704 makes a, frequently, flawed assumption about modern projectors. It assumes that each color can be treated independently. Cyviz' patent deals with the situation where this is not the case.

Cyziv' patent assumes that the output from a projector in response to a red, green, blue is some color+intensity and not as WO 02/19704 assumes that the output of a red, green, blue input is the independent sum of the red+green+blue output contributions.

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This is a crucial difference for a number of mathematical and practical reasons.

Finding the inverse of $f(r/g/b)$, can be done via table lookup (+interpolation if necessary).

Finding the inverse, if it exists at all, of $f(r, g, b) \Rightarrow XYZ$ is highly non-trivial. Cyviz' patent suggests that a downhill simplex simulated annealing algorithm can do the job.

Further Cyviz' patent identifies that in practical terms the inverse of the gamma function is unsuitable for interpolation/tabulation since if it were to be used in the calculation of the edge blending pixels, it would cause serious artifacts due to the shape of the inverse function and the high number of dimensions being tabulated.

Instead Cyviz' patent tabulates the function $f(r, g, b, \text{beta})$ (red, green, blue, beta=blending factor 0..1), which, although a higher number of dimensions, much more suited to tabulation and interpolation.

Conclusion:

One of the most important differences between Cyviz' patent application and other work done in the field is thus that Cyviz' patent minimizes the modification of the image before it is sent to the projector. Also, the Cyviz' patent does not pre-warp the image or otherwise tries to compensate for luminance/color variations.

The advantage of using physical calibration + minimum modification of the signal to the projectors in the overlap region is that the full dynamic range and resolution of the projector is retained.

Physical calibration scores over prewarping or otherwise modifying the input signal to the projectors to compensate for various effects, because the full dynamic range and resolution of the projector is retained.

Enclosed is a new and specified set of claims.

Sincerely yours

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Dag Thrane

C l a i m s

1. Method for accurately and efficiently calculating the input signals to at least two light projectors for creating an invisible transition zone between them,
wherein the dimensions of the transition zone is known, and the emitted
5 light toward the transition zone from each projector is based on a predetermined transfer function from input signal to the projected image in the transition zone, and
wherein the input to the light projectors are provided from a tabulated function of using red, green, blue and blending factor, said tabulated functions for each projector at each point providing a sum constituting the transfer function in the point,
10 so as to obtain predictable image characteristics in the transition zone,
the projected image at each position in the transition zone thus being constituted by the contribution from each of the projectors, the ratio of the contribution from each projector being determined by the chosen blending factor for this position.
- 15 2. Method according to claim 1, wherein the input to the light projectors is provided by interpolating the tabulated function.
3. Method according to claim 1 wherein the transfer function is only used ahead of time and not during edge blending when calculating input to projectors.
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4. Method according to claim 1 wherein the inverse transfer function is only used ahead of time and not during edge blending when calculating input to projectors.
5. Method according to claim 1 wherein the transfer function is obtained by
25 measuring the relationship between the input image data and the characteristics of the emitted light.
6. Method according to claim 1, wherein the transfer function is applied to input data to the projector so as to condition the data to obtain the required image
30 characteristics.

7. Method according to claim 1, comprising the step of interpolating between the light characteristics of a first projector to the light characteristics of a second projector over the image transition zone area, so as to provide a smooth transition between the projected images.

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8. Method according to claim 1, wherein the transfer function is determined by known signal to the projector, measuring the emitted light and calculating the transfer function from the measured relationship between applied signal and measured light characteristics.

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9. Method according to claim 8, wherein the applied signal is a ramp from zero output intensity to full output intensity of the projector.

10. Method according to claim 8, wherein the transfer function is measured and calculated as an automatic part of the projector start up procedure.

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11. Control device for at least two image projectors being adapted to project overlapping images at a surface and defining a transition zone between the images from each projector, the device comprising memory means for storing a tabulated function for each projector, and a transfer function describing the relationship between input signal and emitted light of each projector, the sum of said tabulated functions describing the transfer function, and control means for applying said tabulated functions on said input signal to each projector so as to obtain a predictable image characteristics in the transition zone between the at least two projected images.

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